

AMENDMENTS TO THE CLAIMS

1-6. (Cancelled)

7. (Original) A thin film magnetic memory device, comprising:

a plurality of memory cells for retaining storage data, wherein

each of said memory cells includes

an access gate selectively turned ON in data read operation, and

a magnetic storage portion connected in series with said access gate, and

having either a first electric resistance or a second electric resistance higher than said first electric resistance depending on said storage data, and

said magnetic storage portion includes

a first magnetic layer having a fixed magnetization direction,

a second magnetic layer that is magnetized in a same direction as, or in a direction opposite to, that of said first magnetic layer depending on said storage data to be written, and

a first insulating film formed between said first and second magnetic layers, said thin film magnetic memory device further comprising:

a data line that is electrically coupled to the magnetic storage portion of a selected memory cell through a turned-ON access gate of said selected memory cell in data read operation, said selected memory cell being a memory cell selected from said plurality of memory cells for said data read operation;

a reference data line for transmitting in said data read operation a read reference voltage for comparison with a voltage on said data line; and

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a plurality of dummy memory cells for producing said read reference voltage, each of said dummy memory cells being provided for every fixed set of said memory cells, wherein

each of said dummy memory cells includes

a dummy access gate selectively turned ON in said data read operation,

and

a plurality of dummy magnetic storage portions that are electrically coupled to said reference data line in response to turning-ON of said dummy access gate,

each of said dummy magnetic storage portions includes

a third magnetic layer that is magnetized in a fixed direction,

a fourth magnetic layer that is magnetized either in a same direction as, or in a direction opposite to, that of said third magnetic layer, and

a second insulating film formed between said third and fourth magnetic layers, and

each of said dummy magnetic storage portions is connected in series with at least one of the remainder.

8. (Original) The thin film magnetic memory device according to claim 7, wherein a combined resistance of said plurality of magnetic storage portions is equal to said first electric resistance, and said dummy access gate in an ON state has an electric resistance that is larger than that of said access gate in an ON state by a third electric resistance, said third electric resistance being smaller than a difference between said first and second electric resistances.

9. (Original) The thin film magnetic memory device according to claim 8, wherein said dummy access gate includes a field effect transistor receiving an adjustable control voltage at its gate.

10. (Original) The thin film magnetic memory device according to claim 7, wherein a combined resistance of said plurality of dummy magnetic storage portions is equal to a third electric resistance corresponding to an intermediate value of said first and second electric resistances, and said dummy access gate in an ON state has an electric resistance equal to an electric resistance of said access gate in an ON state.

11. (Original) The thin film magnetic memory device according to claim 7, wherein, in normal data write operation, said fourth magnetic layer in at least one of said dummy magnetic storage portions is magnetized in parallel with said second magnetic layer in a memory cell selected from said plurality of memory cells for said data write operation.

12. (Original) The thin film magnetic memory device according to claim 7, further comprising a test mode for writing prescribed data to each of said dummy memory cells, said test mode being conducted independently of normal operation, wherein said fourth magnetic layer in each of said dummy magnetic storage portions is magnetized in said test mode.

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13. (Cancelled)

14. (Cancelled)

15. (New) A thin film magnetic memory device, comprising:

a plurality of memory cells for storing data, wherein

each of said memory cells includes

an access gate selectively turned ON in data read operation,

and

a magnetic storage portion connected in series with said access gate, and having either a first electric resistance or a second electric resistance higher than said first electric resistance depending on the stored data, and

said magnetic storage portion includes

a first group of magnetic elements in a first layer having a fixed magnetization direction,

a second group of magnetic elements in a second layer that is magnetized in a same direction as, or in a direction opposite to, that of said first group of magnetic elements depending on the data to be written, and

a first insulating film formed between said first and second groups of magnetic elements,

said thin film magnetic memory device further comprising:

a data line that is electrically coupled to a selected memory cell through a turned-ON access gate of said selected memory cell in said data read operation, said selected

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memory cell being a memory cell selected from said plurality of memory cells for said data read operation;

a reference data line for transmitting in said data read operation a read reference voltage for comparison with a voltage on said data line; and

a plurality of dummy memory cells for producing said read reference voltage, each of said dummy memory cells being provided for every fixed set of said memory cells, wherein

each of said dummy memory cells includes

a dummy access gate selectively turned ON in said data read operation,

and

a plurality of dummy magnetic storage portions that are electrically coupled to said reference data line in response to turning-ON of said dummy access gate,

each of said dummy magnetic storage portions includes

a third group of magnetic elements in a first layer that is magnetized in a fixed direction,

a fourth group of magnetic elements in a second layer that is magnetized either in a same direction as, or in a direction opposite to, that of said third group of magnetic elements magnetic, and

a second insulating film formed between said third and fourth groups of magnetic elements, and

each of said dummy magnetic storage portions is connected in series with at least one of the remainder.

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16. (New) The thin film magnetic memory device according to claim 15, wherein a combined resistance of said plurality of dummy magnetic storage portions is equal to a third electric resistance corresponding to an intermediate value of said first and second electric resistances, and said dummy access gate in an ON state has an electric resistance equal to an electric resistance of said access gate in an ON state.

17. (New) The thin film magnetic memory device according to claim 15, wherein, in normal data write operation, data is written to at least one of said dummy magnetic storage portions in parallel with said second layer in a memory cell selected from said plurality of memory cells for said data write operation.

18. (New) The thin film magnetic memory device according to claim 15, further comprising a test mode for writing prescribed data to each of said dummy memory cells, said test mode being conducted independently of normal operation, wherein data is written to at least one of said dummy magnetic storage portions in said test mode.

19. (New) A thin film magnetic memory device, comprising:

a plurality of memory cells for storing data, wherein

each of said memory cells includes

an access gate selectively turned ON in data read operation,

and

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a magnetic storage portion connected in series with said access gate, and having either a first electric resistance or a second electric resistance higher than said first electric resistance depending on the stored data, and

said thin film magnetic memory device further comprising:

a data line that is electrically coupled to a selected memory cell through a turned-ON access gate of said selected memory cell in said data read operation, said selected memory cell being a memory cell selected from said plurality of memory cells for said data read operation;

a reference data line for transmitting in said data read operation a read reference voltage for comparison with a voltage on said data line; and

a plurality of dummy memory cells for producing said read reference voltage, wherein

each of said dummy memory cells includes

a dummy access gate selectively turned ON in said data read operation, and

a plurality of dummy magnetic storage portions that are electrically coupled to said reference data line in response to turning-ON of said dummy access gate,

each of said dummy magnetic storage portions is connected in series with at least one of the remainder.

20. (New) The thin film magnetic memory device according to claim 19, wherein each of said dummy magnetic storage portions is further connected in parallel with at least one of the remainder.

21. (New) The thin film magnetic memory device according to claim 19, wherein a combined resistance of said plurality of dummy magnetic storage portions is equal to a third electric resistance corresponding to an intermediate value of said first and second electric resistances, and said dummy access gate in an ON state has an electric resistance equal to an electric resistance of said access gate in an ON state.

22. (New) The thin film magnetic memory device according to claim 19, wherein, in normal data write operation, data is written to at least one of said dummy magnetic storage portions in parallel with said magnetic storage portion in a memory cell selected from said plurality of memory cells for said data write operation.

23. (New) The thin film magnetic memory device according to claim 19, further comprising a test mode for writing prescribed data to each of said dummy memory cells, said test mode being conducted independently of normal operation, wherein data is written to at least one of said dummy magnetic storage portions in said test mode.

24. (New) A thin film magnetic memory device, comprising:
a plurality of memory cells for storing data, wherein
each of said memory cells includes
an access gate selectively turned ON in data read operation, and
a magnetic storage portion connected in series with said access gate, and
having either a first electric resistance or a second electric resistance higher than said first electric resistance depending on the stored data, and

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said thin film magnetic memory device further comprising:

a data line that is electrically coupled to a selected memory cell through a turned-ON access gate of said selected memory cell in said data read operation, said selected memory cell being a memory cell selected from said plurality of memory cells for said data read operation;

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a reference data line for transmitting in said data read operation a read reference voltage for comparison with a voltage on said data line; and

a plurality of dummy memory cells for producing said read reference voltage, wherein

each of said dummy memory cells includes

a dummy access gate selectively turned ON in said data read operation, and

a plurality of dummy magnetic storage portions that are electrically coupled to said reference data line in response to turning-ON of said dummy access gate, wherein an electric resistance of said plurality of dummy magnetic storage portions is equal to said first electric resistance, and said dummy access gate in an ON state has an electric resistance that is larger than that of said access gate in an ON state by a third electric resistance, said third electric resistance being smaller than a difference between said first and second electric resistance.

25. (New) The thin film magnetic memory device according to claim 24, wherein said dummy access gate includes a field effect transistor receiving an adjustable control voltage at its gate.

26. (New) The thin film magnetic memory device according to claim 24, wherein, in normal data write operation, data is written to at least one of said dummy magnetic storage portions in parallel with said magnetic storage portion in a memory cell selected from said plurality of memory cells for said data write operation.

27. (New) The thin film magnetic memory device according to claim 24, further comprising a test mode for writing prescribed data to each of said dummy memory cells, said test mode being conducted independently of normal operation, wherein data is written to at least one of said dummy magnetic storage portions in said test mode.

28. (New) A thin film magnetic memory device, comprising:

a plurality of memory cells for storing data, wherein

each of said memory cells includes

an access gate selectively turned ON in data read operation,

and

a magnetic storage portion connected in series with said access gate, and having either a first electric resistance or a second electric resistance higher than said first electric resistance depending on the stored data, and

said thin film magnetic memory device further comprising:

a data line that is electrically coupled to a selected memory cell through a turned-ON access gate of said selected memory cell in said data read operation, said selected

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memory cell being a memory cell selected from said plurality of memory cells for said data read operation;

a reference data line for transmitting in said data read operation a read reference voltage for comparison with a voltage on said data line; and

a plurality of dummy memory cells for producing said read reference voltage, wherein

each of said dummy memory cells includes

a dummy access gate selectively turned ON in said data read operation,

a plurality of dummy magnetic storage portions that are electrically coupled to said reference data line in response to turning-ON of said dummy access gate, and

a dummy resistance gate made of a field effect transistor, and wherein an electric resistance of said plurality of dummy magnetic storage portions is equal to said first electric resistance, and said dummy access gate in an ON state has an electric resistance that is equal to that of said access gate in an ON state, and said dummy resistance gate has a third electric resistance, said third electric resistance being smaller than a difference between said first and second electric resistance.

29. (New) The thin film magnetic memory device according to claim 28, wherein said field effect transistor has a gate receiving an adjustable control voltage.

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30. (New) The thin film magnetic memory device according to claim 28, wherein, in normal data write operation, data is written to at least one of said dummy magnetic storage portions in parallel with said magnetic storage portion in a memory cell selected from said plurality of memory cells for said data write operation.

31. (New) The thin film magnetic memory device according to claim 28, further comprising a test mode for writing prescribed data to each of said dummy memory cells, said test mode being conducted independently of normal operation, wherein data is written to at least one of said dummy magnetic storage portions in said test mode.

32. (New) A memory device comprising:

- a memory cell storing data with its resistance;
- a data line electrically connected to said memory cell in a data read operation; and
- a dummy memory cell producing a read reference voltage for comparison with a voltage on said data line in said data read operation, wherein

said memory cell includes

- a first resistor element having a resistance varied in accordance with the stored data, and
- a select gate for selectively connecting said memory cell to said data line in said data read operation, and

said dummy memory cell includes

- a second resistor element having a resistance characteristic similar to a resistance characteristic of said first resistor element,

a dummy cell select gate having a resistance similar to a resistance of said select gate, and

a third resistor element made of a field effect transistor.

33. (New) A memory device comprising:

a memory cell storing data with its resistance;

a data line electrically connected to said memory cell in a data read operation; and

a dummy memory cell producing a read reference voltage for comparison with a voltage on said data line in said data read operation; wherein

said memory cell includes

a first resistor element having a resistance varied in accordance with the stored data and

a select gate for selectively connecting said memory cell to said data line in said data read operation, and

said dummy memory cell includes

a plurality of second resistor elements each having a resistance characteristic similar to a resistance characteristic of said first resistor element, and

a dummy cell select gate having a resistance similar to a resistance of said select gate, and

said plurality of second resistor elements are electrically connected with each other so that at least two of said plurality of second resistor elements are connected in series.